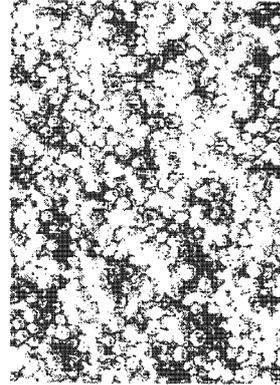
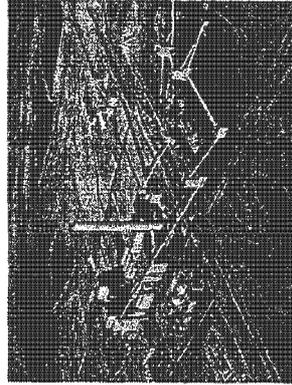


Profitable Compliance

ENGINEERED SYSTEMS



Opportunities for



Intermountain Power Agency

Feasibility Study Kick-Off
Meeting

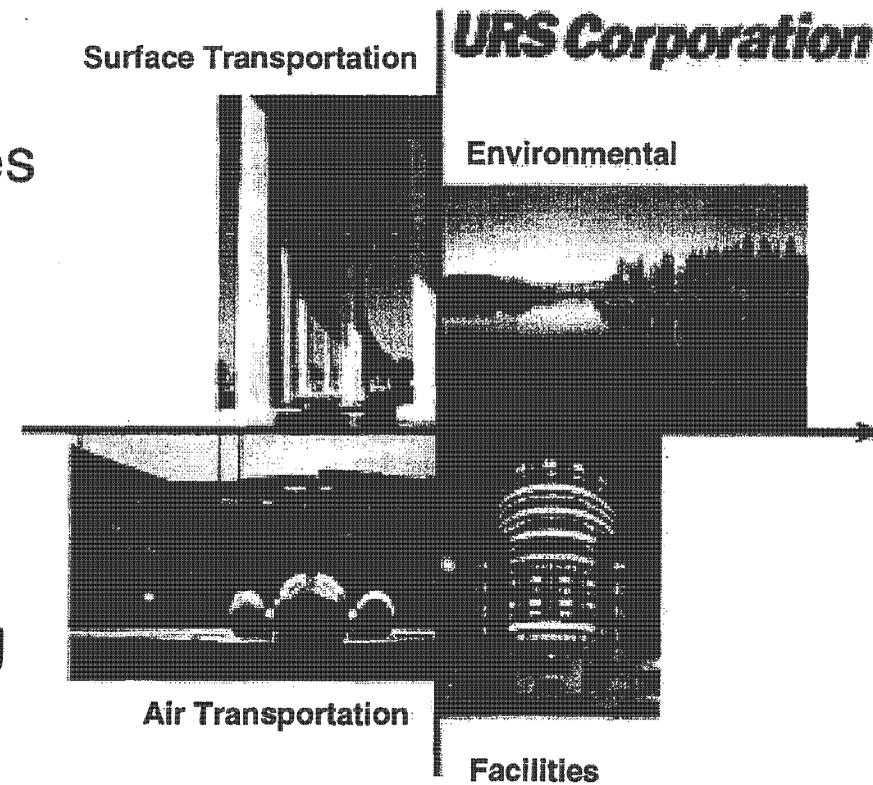
August 10, 1999

Topics

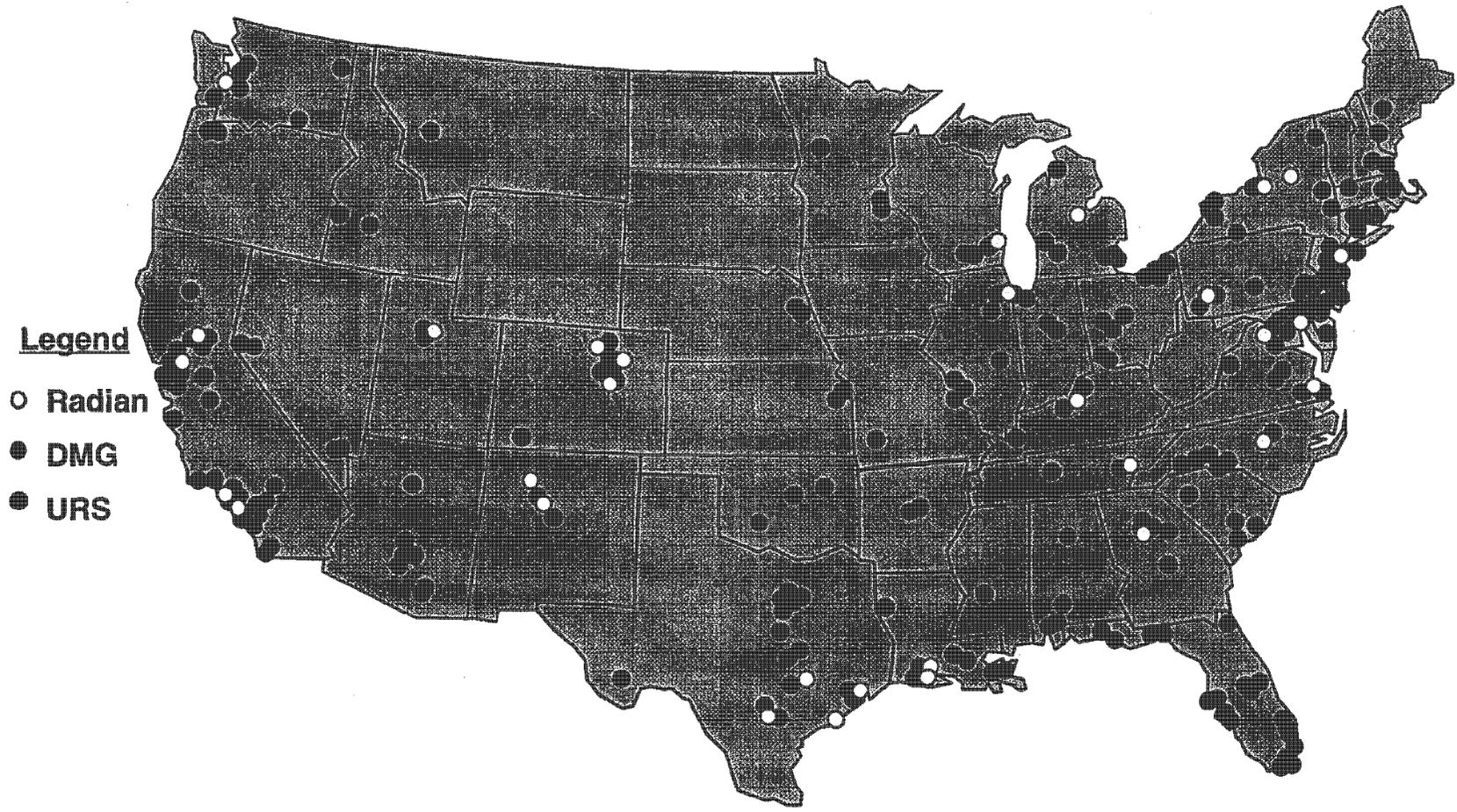
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 - ✓ Legal Issues
- Cost Estimate
- Action Items

URS Corporation

- **URS Corporation**
 - ✓ 15,000 employees
 - ✓ \$2 billion in revenues
- **Family of Companies**
 - ✓ URS Corporation
 - ✓ Dames & Moore Group
 - ✓ Greiner Engineering
 - ✓ Woodward-Clyde Group



URS LOCATIONS IN THE U.S.



Product & Services

Products

- **SynGyp™** Turnkey conversion to wallboard grade gypsum
- **Ammonium Sulfate** Turnkey conversion to high grade fertilizer
- **OverScrub™** Allowance Capture
- **Reagent Conversion,** Lime to limestone
- **Fly Ash Beneficiation,** High grade cement additive

Services

- Financing
- Engineering, Procurement & Construction
- Operation
- Byproduct Marketing
- Continuous Improvement Programs



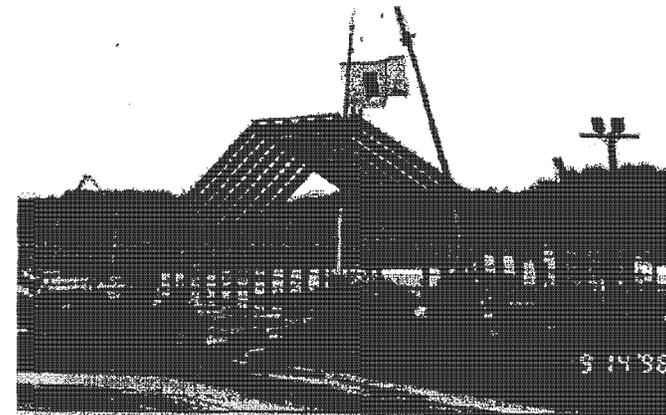
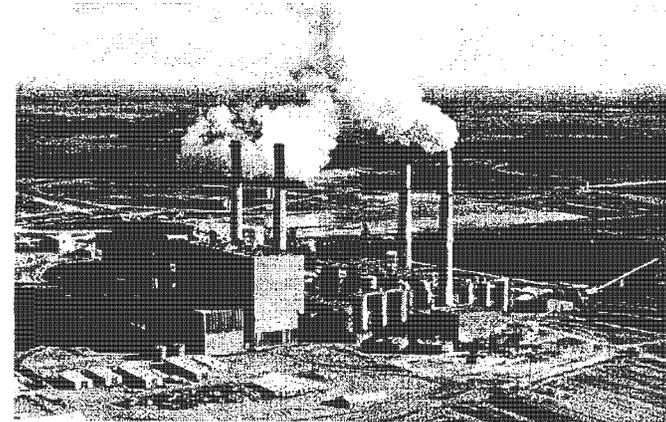
Radian Experience with SynGyp™

- **NIPSCO, Schahfer 17-18, 800MWe**
 - * Gypsum Sold to G-P, co-located Wallboard Plant
 - * Payback 2 - 3 years
- **LG&E, Mill Creek 1-4, 1,600 MWe**
 - * Gypsum Sold to USG
 - * Payback 1 - 2 years
- **SEC, Seminole 1-2, 1,300 MWe**
 - * Gypsum to Wallboard Plant, co-located Wallboard Plant
 - * Payback 1-2 years
- **TXU, Martin Lake, 1-3, 2,400 MWe**
 - * Gypsum to Wallboard, co-located to Wallboard Plant
 - * Payback 2 years



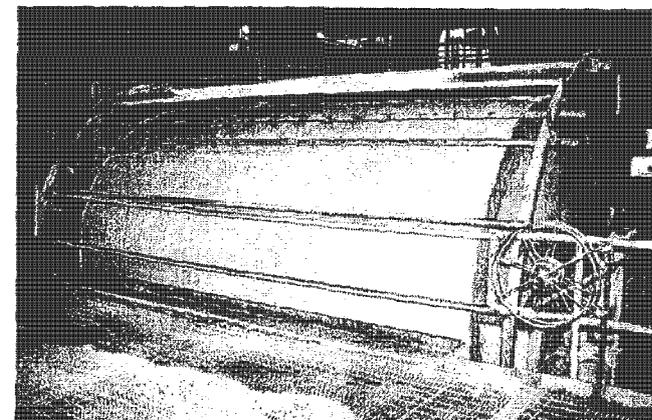
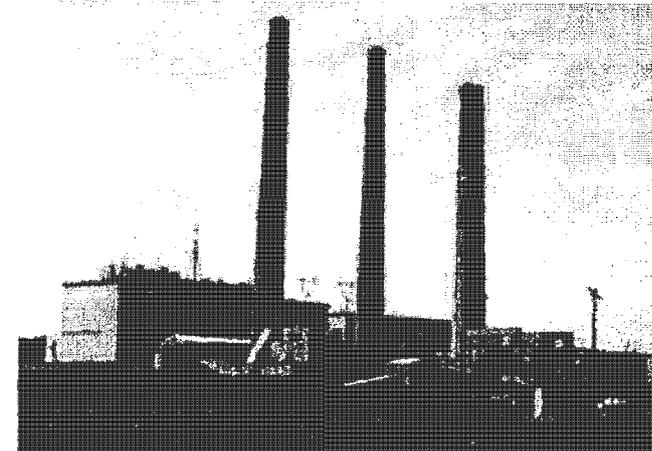
NIPSCO Schahfer

- Dual-Alkali (Lime-Soda Ash)
- Wheatfield, IN
- 2 x 400 MW
- \$26M Capital Cost
- Payback 2-3 years
- Savings increased by 50%
- 6 week outages (2)
- Long-Term Alliance
- Buyer: Georgia-Pacific
- On-Site Wallboard Plant
- Technical Challenges
 - ✓ Disc and donut contactor
 - ✓ Low L/G, incr. from 15 to 50
 - ✓ Shallow reaction tank, 10 ft



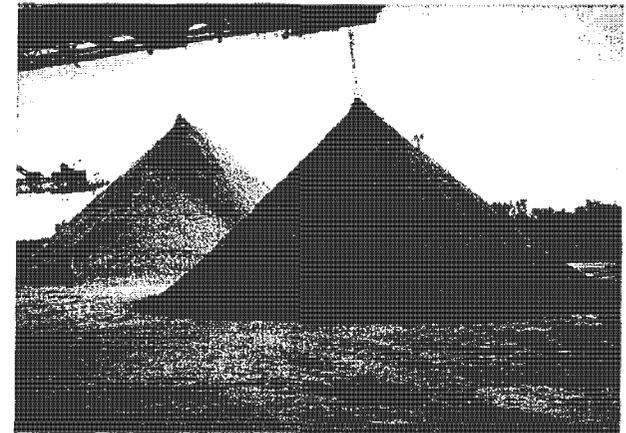
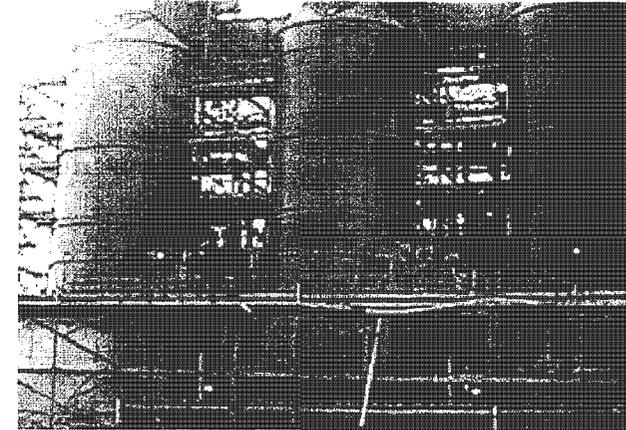
LG&E Mill Creek

- Limestone, Sludge
- Louisville, KY
- 4x400 MW
- \$25M Capital Cost
 - ✓ Gypsum Buyer Co-Invested \$6 million
- Payback 1-2 years
- Project Benefits:
 - ✓ New Landfill Avoided
 - ✓ O&M Savings
 - ✓ Significant tax break
 - ✓ Improved Reliability
- 2 to 8 Week Outages
- Long-Term Alliance
- Buyer: US Gypsum
- Limestone Grinding Project
 - ✓ preground to on-site grinding



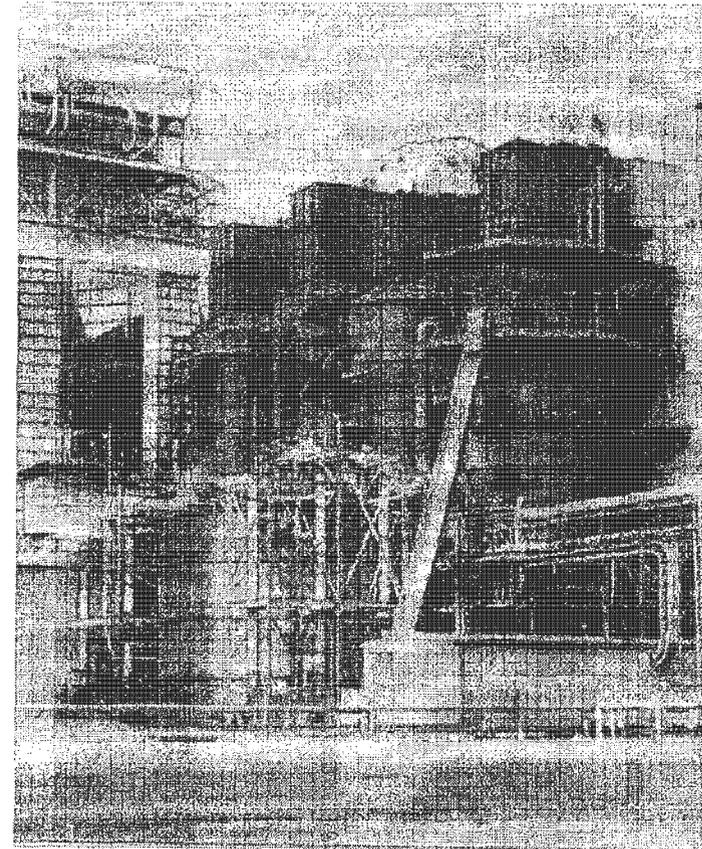
SEC, Seminole

- Limestone, Sludge
- Palatka, Florida
- 2 x 650 MW
- \$16M Capital Cost
- Payback 1-2 years
- Project Benefits:
 - ✓ O&M Savings
 - ✓ SO₂ Allowance Capture
 - ✓ Avoid Landfill Expansion
- 1 to 4 Week Outages
- Long-term Alliance
- Negotiating New Wallboard Plant
- Startup in 2000
- Proprietary Water Treatment



TXU Martin Lake

- Limestone, Sludge
- Tatum, Texas
- 3 x 800 MW
- \$8 M Capital Cost
- Payback 2 years
- Project Benefits:
 - ✓ O&M Savings
 - ✓ SO₂ Allowance Capture
 - ✓ Avoid Landfill Expansion
- Long-term Alliance
- Gypsum Marketing Responsibility
- New Wallboard Plant
- Startup in 2000
- Radian Investing



Topics

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Establish Competitive Position

- Turn environmental compliance into a revenue generator
 - ✓ Fuel blending
 - ✓ Valuable byproduct
- Leverage Radian's proposal
 - ✓ FGD Technologies and experience
 - ✓ Business offering and market know-how
- Focus on power production

Win/Win - First Movers are Rewarded

Conversion Concept

- Convert FGD system to use ammonia and produce ammonium sulfate
 - ✓ Revenue from fertilizer sale
- Use pet coke
 - ✓ Fuel savings
 - ✓ Sulfur boost which will increase ammonium sulfate revenues

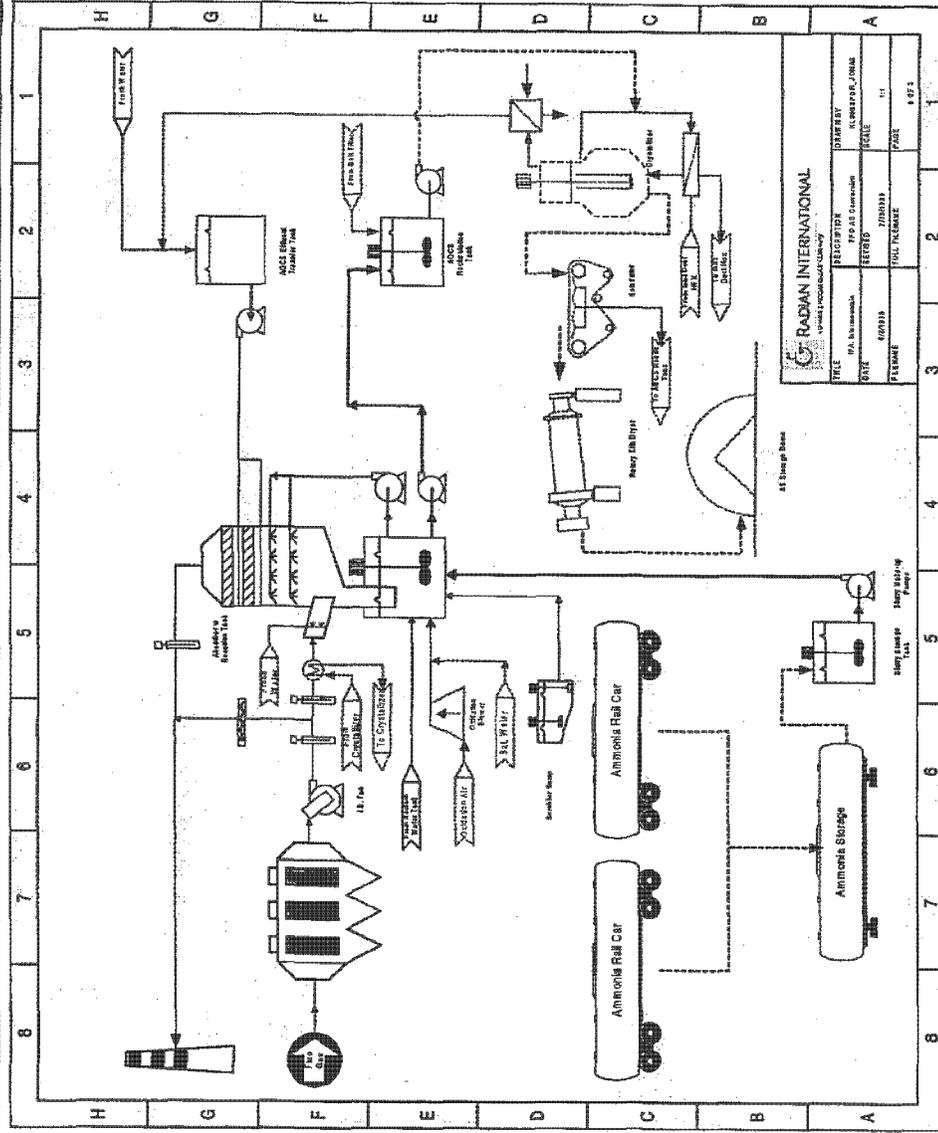
Opportunity - Basic Assumptions

Boiler Size	2x820 MWe
Fuel Heating Value	11,680 Btu/lb
Sulfur Content	0.56 percent
Plant Heat Rate	9,450 Btu/kW-hr
Plant Capacity Factor	94 percent
Coal Usage	4,941 kTPY
Stack SO₂ Emissions	0.09 lbs/MM Btu
Fuel Cost	\$1.35/MM Btu



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Opportunity - SynGyp^{AS}™ Conversion

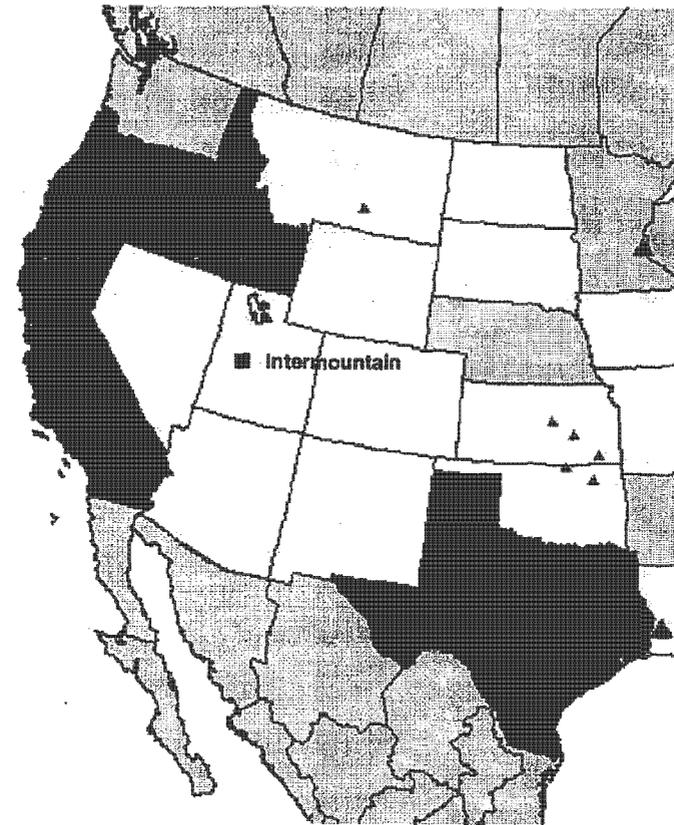


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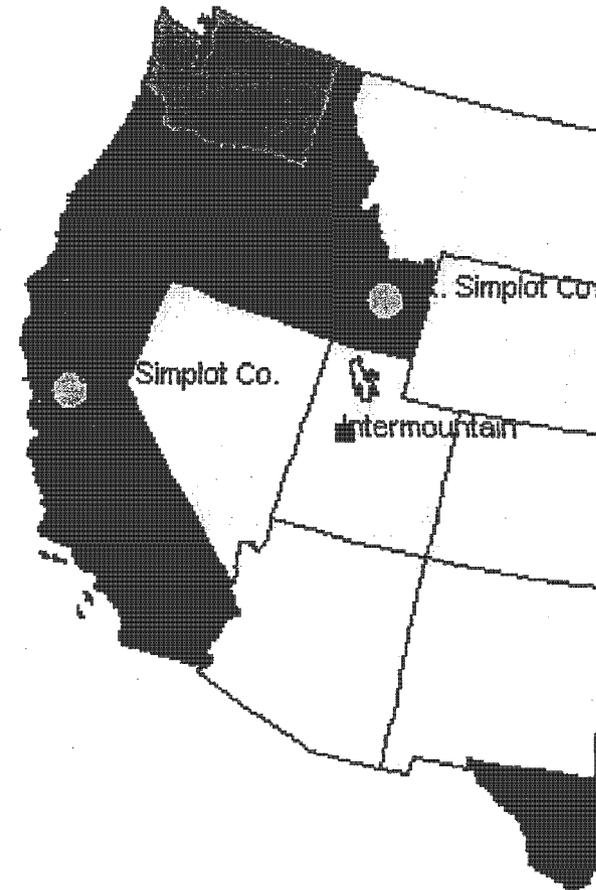
Opportunity - Pet Coke Supply

- Produced by Refineries
 - ✓ Refineries are increasing recovery of crude oils
 - ✓ Capacity expected increase over next five years
- Price is \$0-\$5 per ton plus transportation
- Typical cost as burned 40-60 ¢/MM Btu



Opportunity - AS Market

- Highest Consumption States within Reach
 - ✓ Washington
 - ✓ Oregon
 - ✓ Idaho
 - ✓ California
- Main Competition is High Cost Virgin Producers
 - ✓ J.R. Simplot Co.



Opportunity - Case Study

Area	k\$/yr
Fuel <i>720 kTPY Pet Coke</i>	14,000 - 16,000
Reagent <i>65 kTPY Ammonia</i>	(6,000) - (9,000)
Byproduct <i>250 kTPY Ammonium Sulfate</i>	17,000 - 21,000
Other <i>Labor, Maintenance, Power</i>	(2,000) - (3,000)
Annual Savings	20,000 - 29,000

Business Offer to IPA

- IPA and Radian to form an Alliance/JV to pursue an SynGypAS™ conversion at Intermountain
- Radian would provide all SynGypAS™ technology and guarantee performance of AS production
- Radian would assume turn-key responsibility for engineering and construction
- Radian would assume responsibility for ammonia sourcing and ammonium sulfate marketing
- Radian would assist IPA on pet coke sourcing
- Long-term on-site technical support
- Project benefits would be split equally

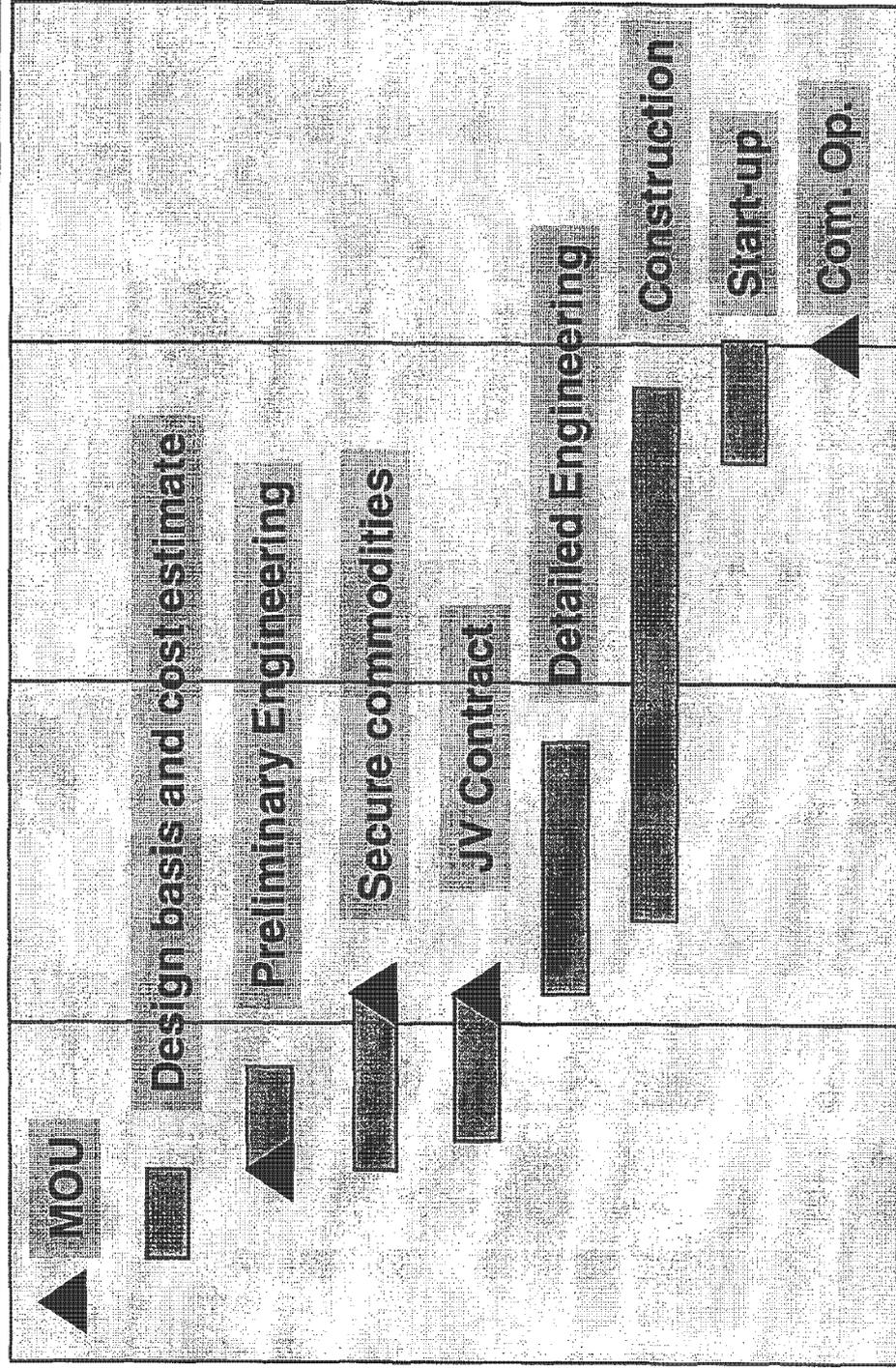


Stepwise Project Approach

- Sign a non-disclosure agreement
- Feasibility study
 - * Technical and market issues
 - * Project economics
 - * Business concept
- Sign a Memorandum of Agreement
- Feasibility study review meeting
- Limited engineering release
- Final project review
- Sign contract
- Launch project



Preliminary Schedule



2001

2000



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Radian's Team

- Leslie Wilkinson
 - Jonas Klingspor
- } Core team members,
market, technical,
- Bill Horton, Process
 - Tim Thomas, Estimating & EPC
 - Don Jackson, Financing
 - Patti Kimes, Permitting
 - Kelly Kocurek, Legal
 - Rich McMillan, Pet coke combustion



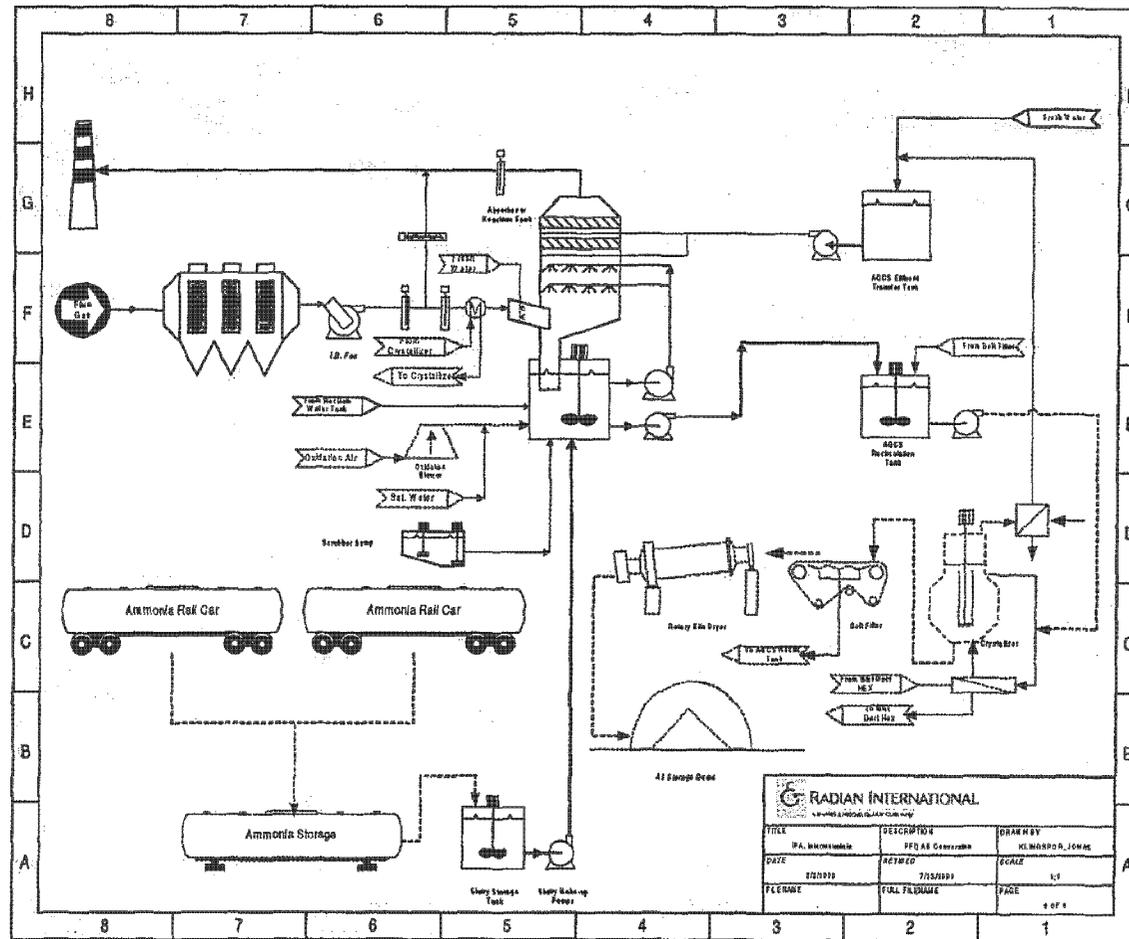
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Opportunity - SynGypAS™ Conversion



IP12_013661

Ammonium Sulfate Process

● SynGyp™

- ✓ Reagent Prep,
Storage & Delivery
- ✓ Absorber System
 - * Forced Oxidation
- ✓ Dewatering
 - * Pond
 - * Thickener or
hydroclone
 - * Drum or belt filter
- ✓ Storage
- ✓ Chloride Blowdown

● SynGypAS™

- ✓ Ammonia Storage &
delivery
- ✓ Absorber System
 - * Forced oxidation
- ✓ Dewatering
 - * Crystallizer
 - * Centrifuge
 - * Dryer
- ✓ Storage



Chemistry

● SynGyp™

- ✓ Limestone dissolution
- ✓ Dissolved and suspended solids
 - * 15% solids
 - * pH 5-6
- ✓ Oxidation
- ✓ Crystallization
 - * scaling potential

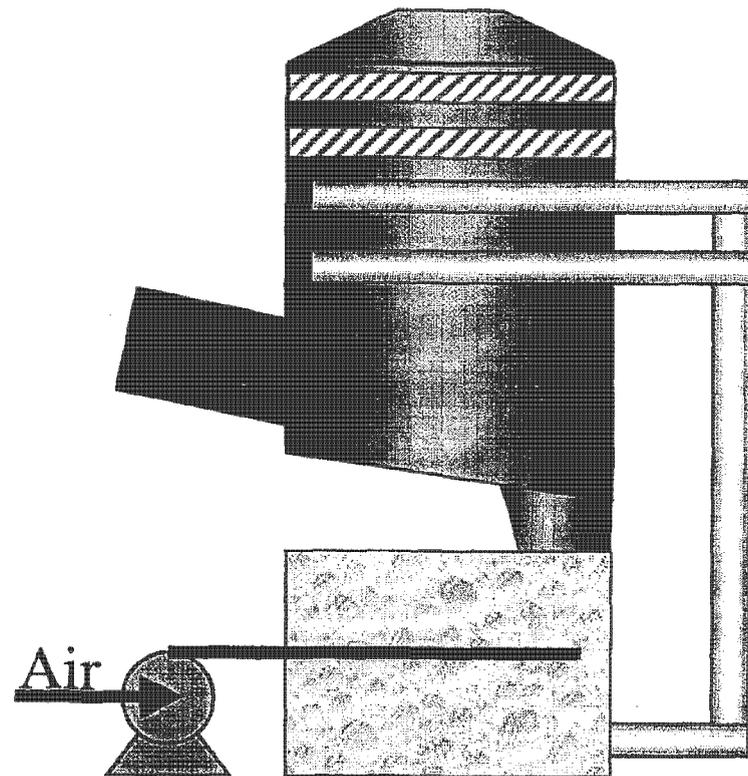
● SynGypAS™

- ✓ Ammonia hydration
- ✓ Clear solution
 - * 30% ammonium sulfate
 - * pH 5-5.5
 - * No scaling potential
- ✓ Oxidation

No Scaling Potential - Simple Operation

Absorber Design

- Switchable between AS and LSFO
 - ✓ Identical sizing
 - * Reaction tank
 - * L/G
 - ✓ Identical spray pumps size
 - ✓ Identical oxidation systems
 - ✓ Identical spray header design
 - ✓ Identical material requirements

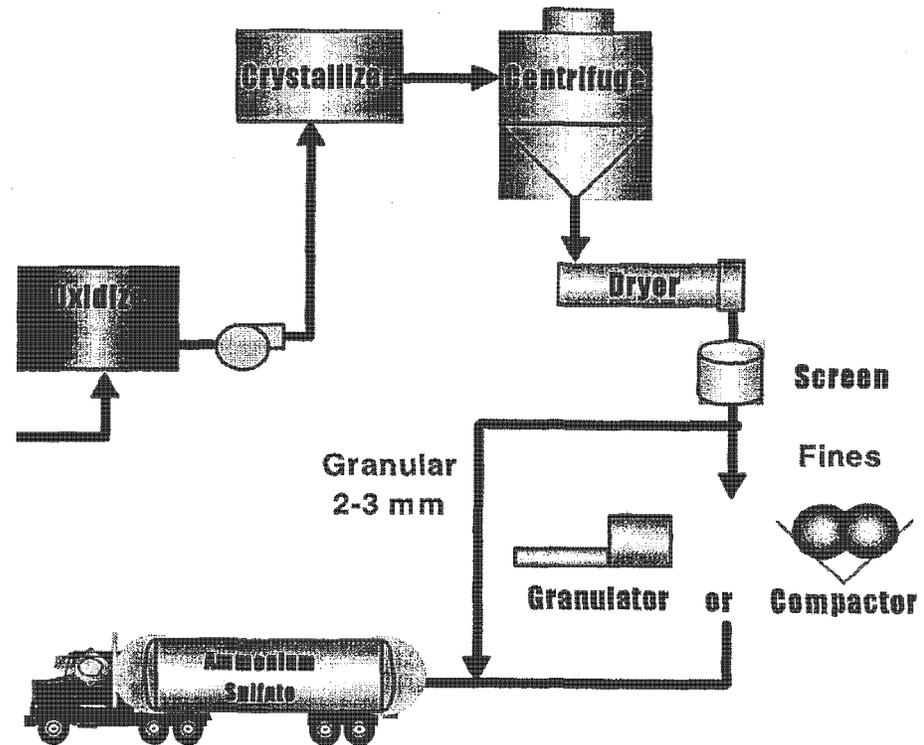


Ammonium Sulfate Treatment Systems

- Standard equipment

- ✓ Crystallizer
 - × 75% to 25% water
 - × Waste heat
 - steam
 - flue gas
- ✓ Centrifuge
 - × 25% to 2% water
- ✓ Dryer
 - × 2% to 0.1% water
- ✓ Granulator
 - × 2-3 mm size crystals

- Process know-how



Ammonium Sulfate Installations

● DTB Crystallizers

✓ 67 Installed Since 1937

✖ 1 - 70 tons per hour

✓ CF Chemical, Plant City, FL

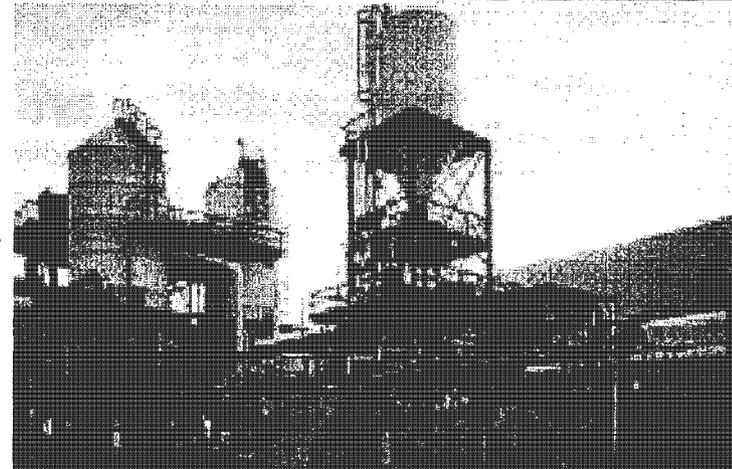
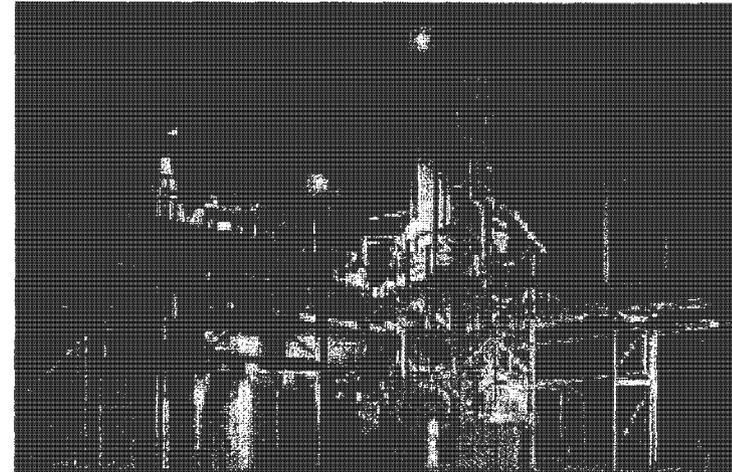
✖ Ammonium Sulfate from waste streams

✖ 3 tons per hour

✓ DOW, Freeport, TX

✖ Ammonium Sulfate from NH_3 and H_2SO_4

✖ 30 tons per hour

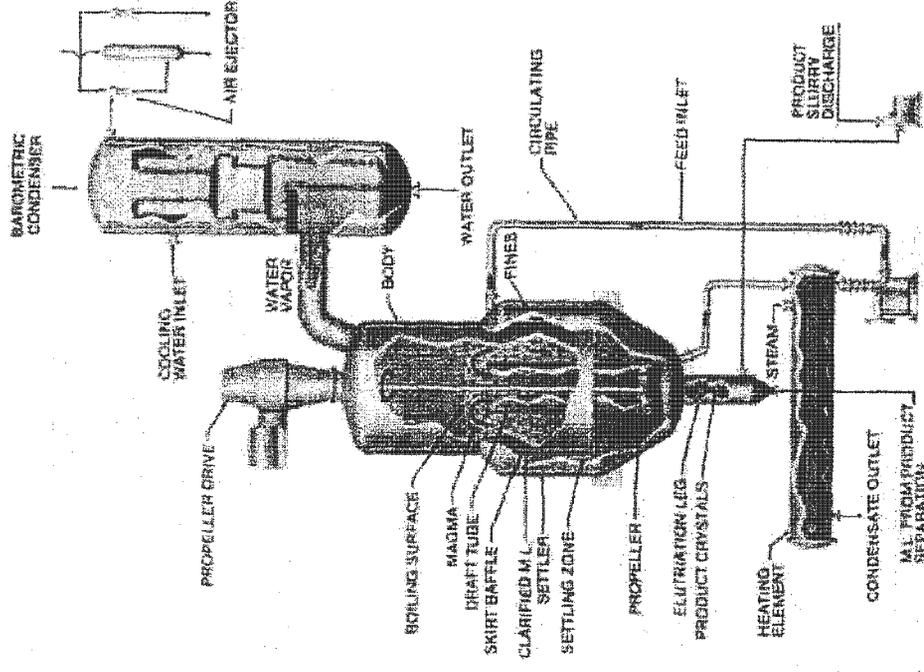


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Draft Tube Baffle Crystallizer

- Draft Tube Baffle (DTB) Crystallizer

- ✓ Used predominately for fertilizer manufacturing
- ✓ Growing crystals are brought to surface by low speed pump
 - ✗ most intense supersaturation
 - ✗ low superheating
 - ✗ rapid growth
- ✓ Baffle permits gravitational separation of fines
- ✓ Sufficient seed surface is maintained



Technical Issues

- Process design
- Ammonia unloading, storage & handling
- Heat extraction
- Crystallization
- Interface

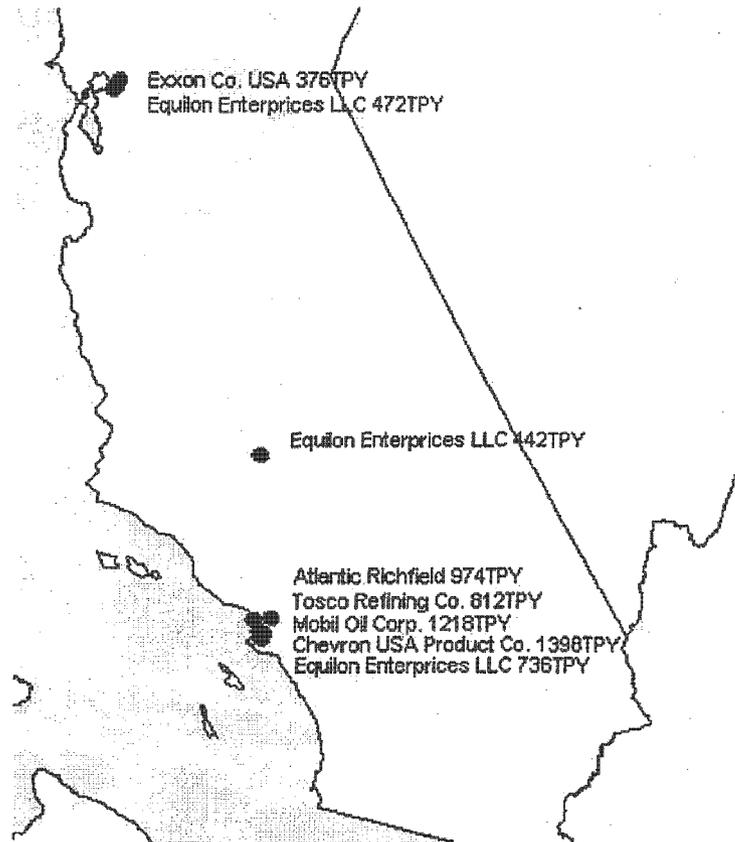
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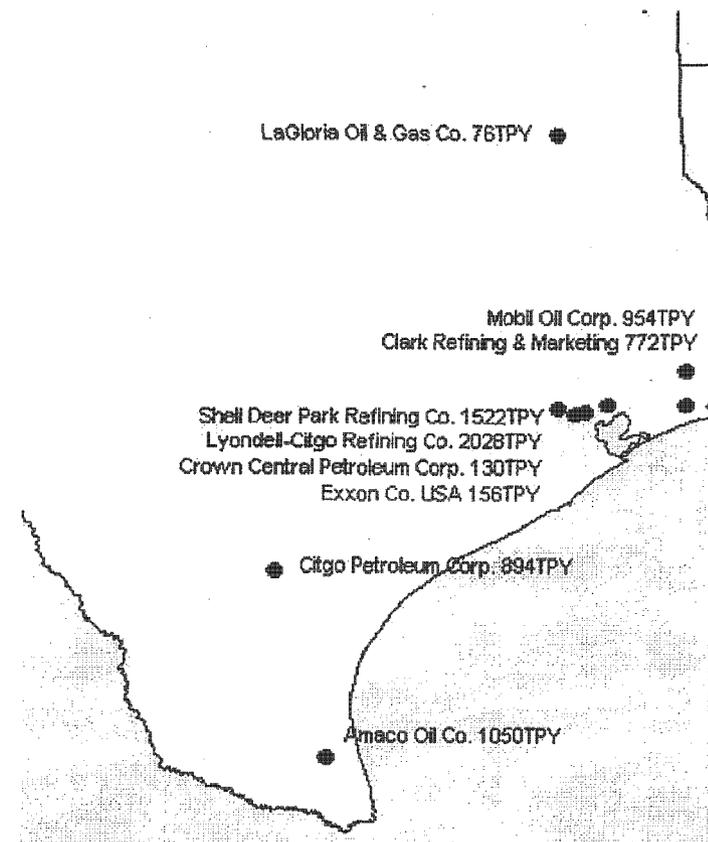


Pet Coke Market

Pacific Coast



Gulf Coast



IP12_013670

Market Summary

- US Production

- ✓ Currently 39,000k TPY
- ✓ Expected to increase to 60,000k TPY in five years

- Price

- ✓ Pacific Coast, -\$5 to \$5/ton
- ✓ Gulf Coast, \$0 to \$5/ton

- Characteristics

- ✓ Hardness, 35HGI to 85 HGI
- ✓ Sulfur , 2-4% (Pacific), 4-6% (Gulf)

Opportunity - Pet Coke Users

Name	Station	Unit No.	FGD	Size	Boiler Type
AES Deepwater	Houston	1,2	Yes	140 MW each	Vertical Fired PC
Alliant (IES)	Sutherland	1,2	No	38 MW each	Front-Fired PC
	Sutherland	3	No	82 MW	Cyclone
Alliant (WP&L)	Nelson Dewey	1,2	No	120 MW each	Cyclone
Ameren (Union Electric)	Sioux	1,2	No	549 MW each	Cyclone
	Meramec	1,2	No	137 MW each	Tangential-Fired PC
	Meramec	3,4	No	289 & 359 MW	Front-Fired PC
Big Rivers Electric (LG&E)	Wilson	1	Yes	500 MW	Opposed-Fired PC
	Green	1,2	Yes	260 MW each	Opposed-Fired PC
	Henderson	1,2	Yes	180 & 184 MW	Front-Fired PC
Central Electric Power	Chamois	2,3	No	44 MW each	Cyclone
Cinergy (CG&E)	Beckjord	5,6	No	240 & 460 MW	Tangential-Fired PC
	Miami Fort	6,7	No	160 & 560 MW	Opp & Tangential PC
First Energy (Penn Power)	Mansfield	1,2,3	Yes	900 MW each	Opposed Fired PC
First Energy (Ohio Edison)	Burger	3,4,5	No	100 & 160 MW	Front Fired PC
Houston Industries (HL&P)	Limestone	1,2	Yes	800 MW	Tangential-Fired PC
Illinois Power Co	Hennipen	1,2	No	75 & 230 MW	Tangential-Fired PC
	Wood River	4,5	No	110 & 380 MW	Tangential-Fired PC
Indianapolis Power & Light	Petersburg	3,4	Yes	574 MW each	Tangential-Fired PC
Jacksonville Electric	St. Johns River	1,2	Yes	670 MW each	Opposed-Fired PC
Lakeland Electric	McIntosh	3	Yes	330 MW	Opposed-Fired PC
Manitowoc Public Utilities	Manitowoc	1	CFB	20 MW	CFBC



Opportunity - Pet Coke Users

Name	Station	Unit No.	FGD	Size	Boiler Type
Michigan South Central	Endicott	1	Yes	55 MW	Front-Fired PC
Northern Indiana Pub Ser. Co	Schafer	17,18	Yes	425 MW each	Tangential-Fired PC
	Baily	7,8	Yes	194 & 421 MW	Cyclone
Northern States Power	King	1	No	598 MW	Cyclone
	Riverside	8	No	239 MW	Cyclone
	Bay Front	3	No	25 MW	Cyclone
Owensboro Municipal Utilities	Smith	1	Yes	151 MW	Cyclone
Ottertail Power	Big Stone	1	No	456 MW	Cyclone
Pennsylvania Power & Light	Holtwood	17	No	75 MW	Vertical-Fired PC
	Sunbury	1,2	No	75 MW each	Vertical-Fired PC
San Antonio Public Service	Deely	1,2	No	445 MW each	Tangential-Fired PC
	Spruce	1	Yes	545 MW	Tangential-Fired PC
Seminole Electric Coop	Seminole	1,2	Yes	650 MW each	Opposed-Fired PC
South Carolina Electric & Gas	Cope	1	Yes	420 MW	Tangential-Fired PC
South Carolina Public Service	Cross	1,2	Yes	560 MW each	Oppsd & Tangential
Southern Indiana Elec & Gas	Culley	1,2,3	No	46,99,2x265 MW	Front & Opposed PC
Tampa Electric	Big Bend	4	Yes	480 MW	Opposed-Fired PC
Utilicorp	Sibley	3	No	420 MW	Cyclone
Wisconsin Electric Power Co	Presque Isle	1,6	No	90 MW	Front & Tangential
	Valley	1,2	No	136 MW each	Front-Fired PC



Impact by Pet Coke Use

● Fly Ash

- ✓ Decreased volume
- ✓ Increased LOI, marginal impact below 20% pet coke
- ✓ Increased vanadium & nickel concentration

● Boiler

- ✓ Decreased slagging and fouling
- ✓ Harder deposits
- ✓ Increased SO₃ generation
- ✓ General Corrosion Issues

Test Burn

- Objectives

- ✓ Delivery
- ✓ Storage
- ✓ Blending
- ✓ Combustion & Steam Generation
- ✓ Soot blowing
- ✓ Fly Ash quality
- ✓ Opacity

- Duration, 1 month



Pet Coke Issues

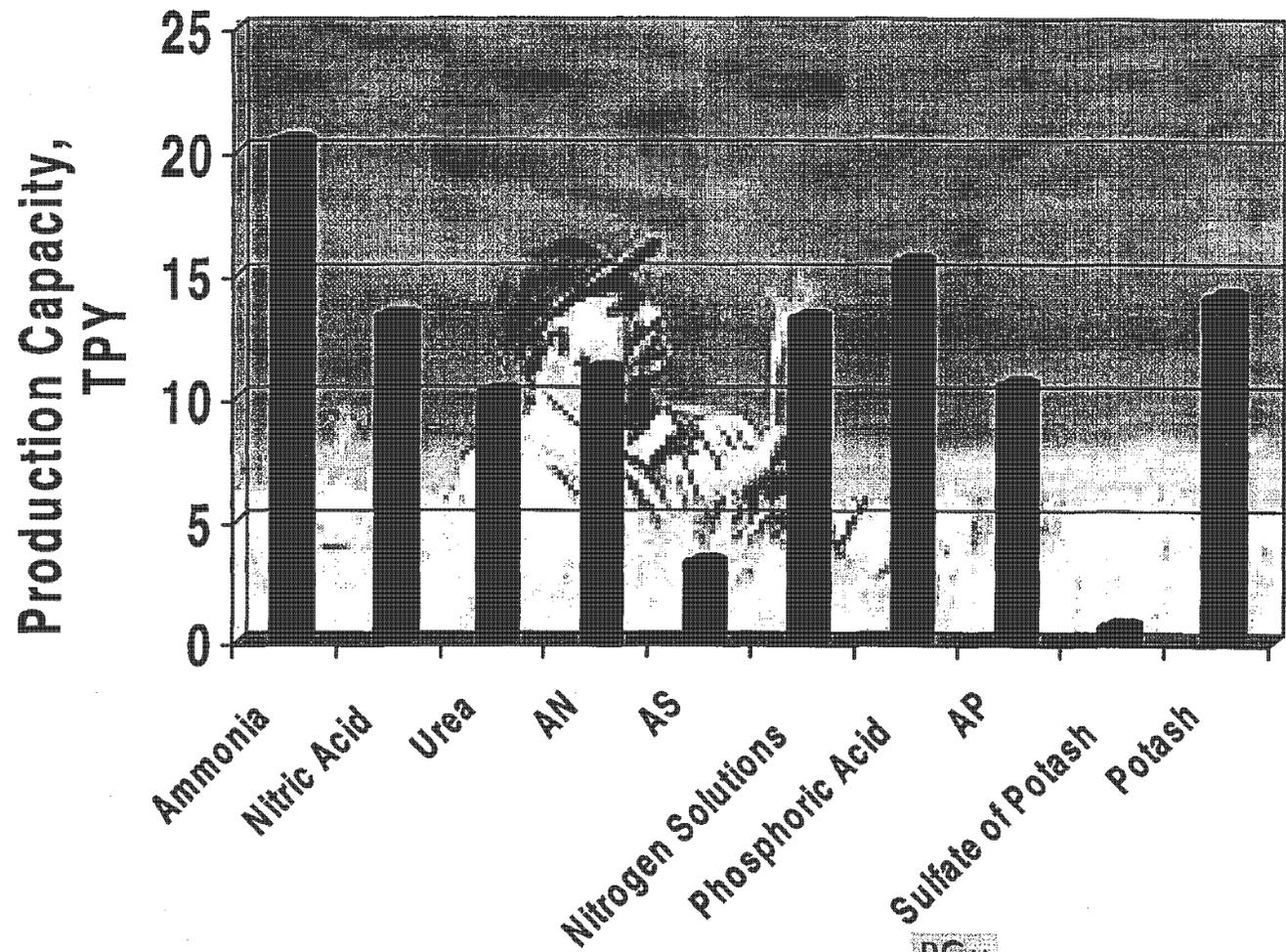
- Fuel contract - limitation of use
- Sellers
- Price
- Transportation
- Boiler impact
- Fly ash impact
- Test burn
- Permit

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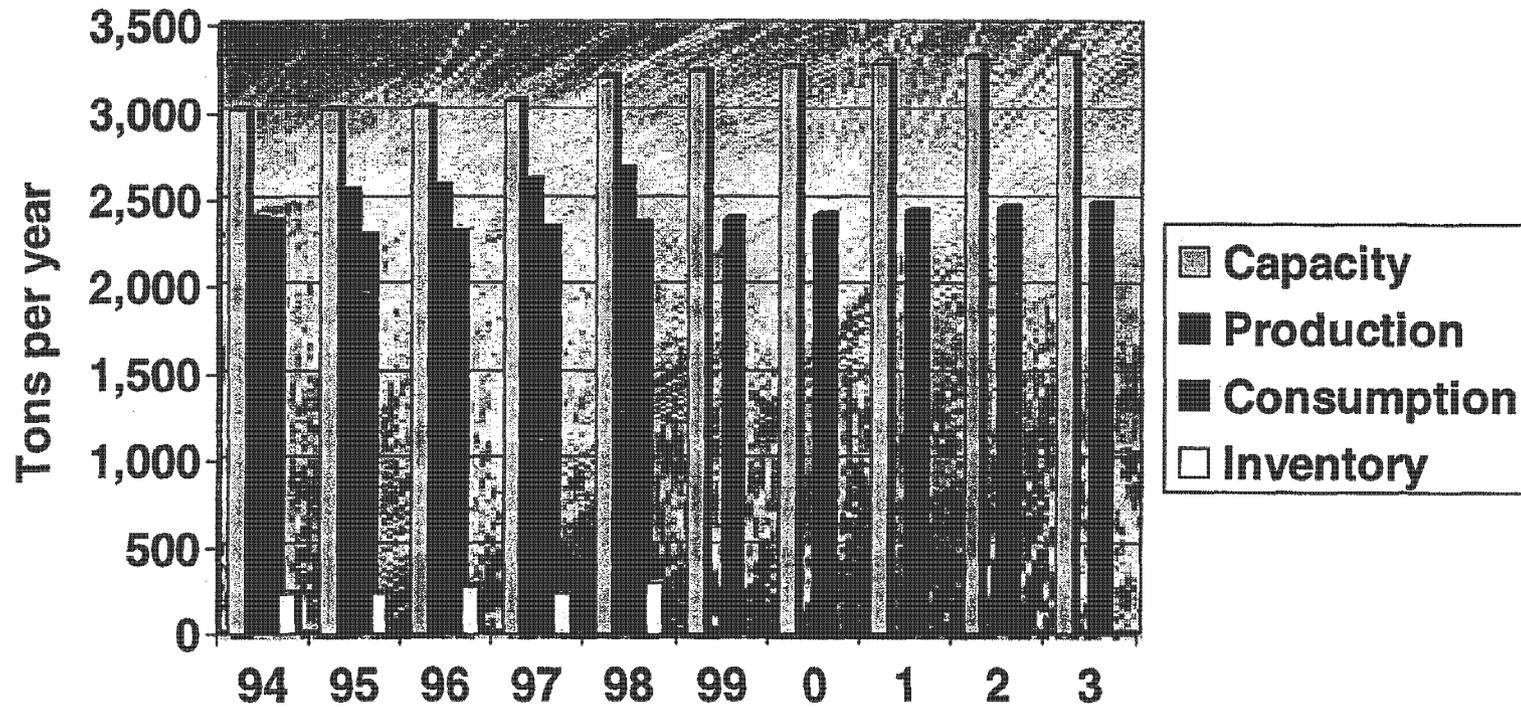


Market - US Fertilizer Stats



IP12_013678

Market - AS Production Stats



**Sulfur Deficiency in the Soil will Increase Demands
Not Included in Future Projection**

Source: IFDC



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Market - US AS Producers

Plant	Granular Standard Thousand tons per year	Total Source
Allied	750	1,500 Caprolactam
DSM	200	40 Caprolactam
BASF	500	550 Caprolactam
Cypress	40	40 Synthetic
Zipp	80	50 Synthetic
Sim ID	25	50 Synthetic
Sim Ca	95	190 Synthetic
Dakota Gas	130	FGD
Others	100	200 Mixed
Total	1,920	1,110 3,030

1,100k TTPY is Exported
700k TTPY is Imported

Source: IFDC

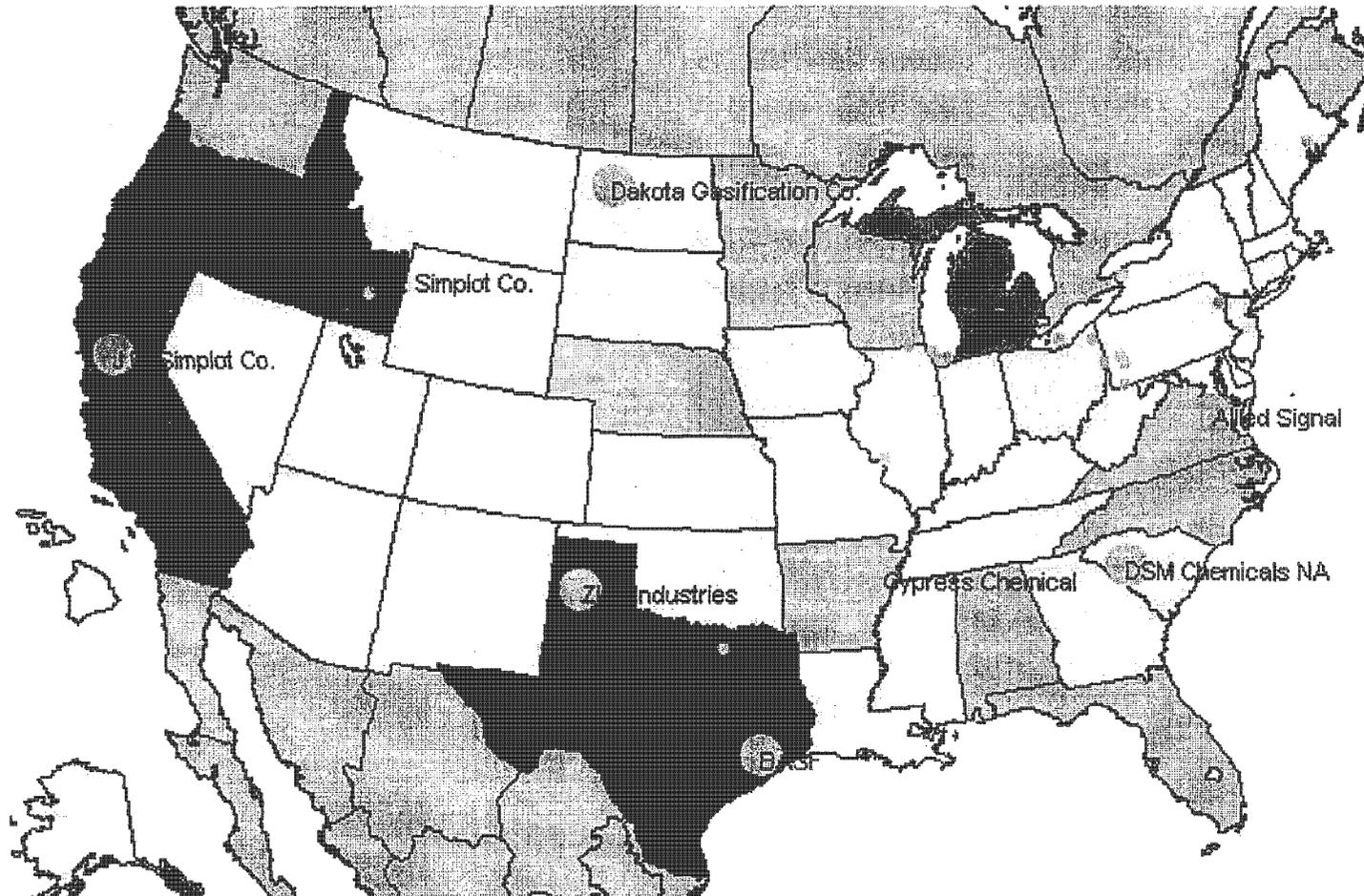
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Market AS Prod. & Cons.



Source: IFDC



Market - AS Products

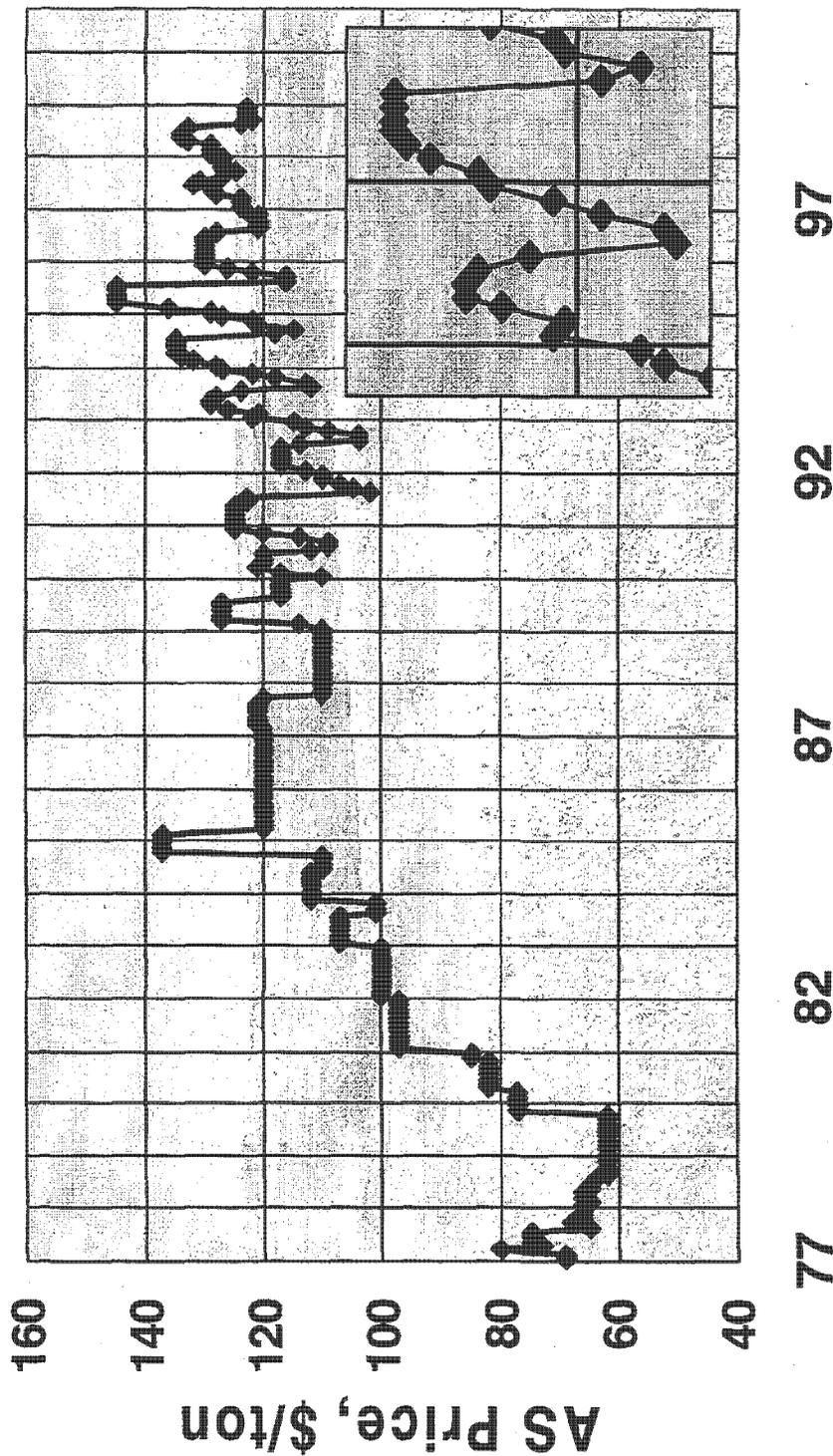
- Granular Material (~70%)
 - ✓ Crystal
 - ✓ Compacted
 - ✓ Typically bulk blended with other fertilizers
- Standard Material or Fine (~30%)
 - ✓ Directly applied to the ground
- Standard Sells at a Discount to Granular
 - ✓ \$50/ton
- Granular Sells at a Premium
 - ✓ \$130/ton

Source: IFDC & Green Markets



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Opportunity - AS Price History



Source: Green Markets

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AS Issues

- Buyers
- Price
- Quality
- Transportation
- Seasonable impacts



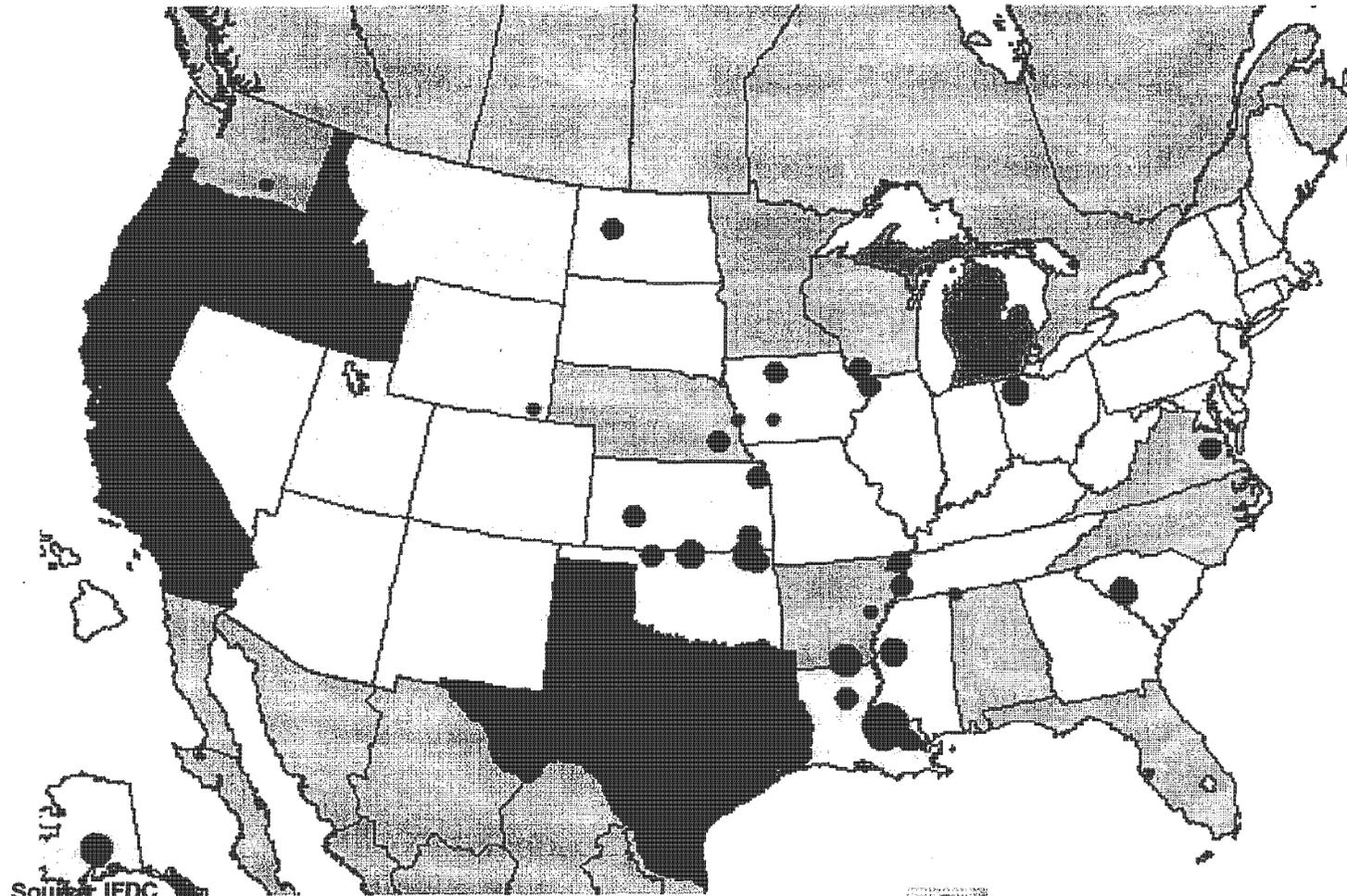
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Opportunity - Ammonia Producers



Source: IFDC

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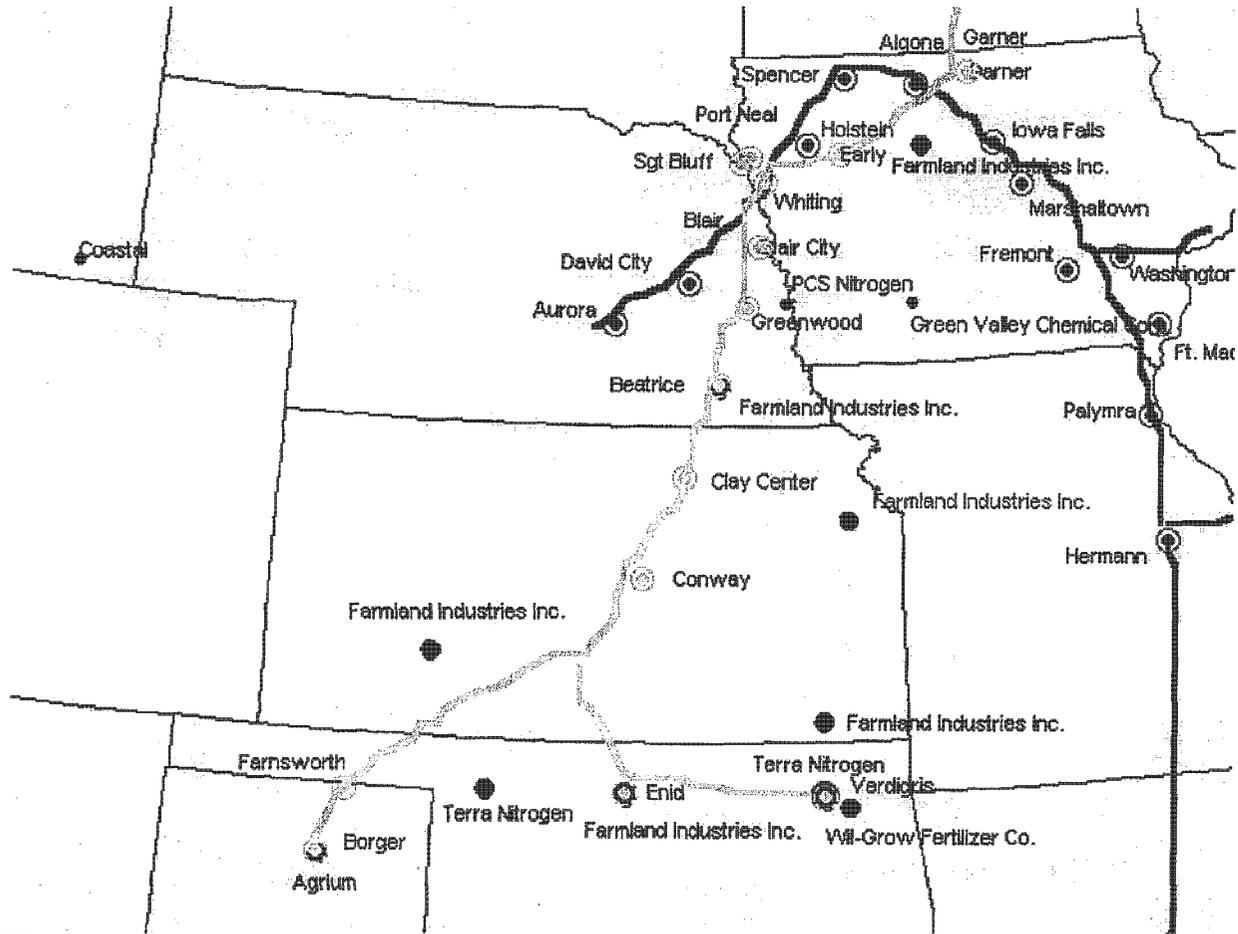


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IP12_013686

Opportunity - Kansas



Source: IFDC

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IP12_013687

Ammonia Issues

- Sellers
- Price



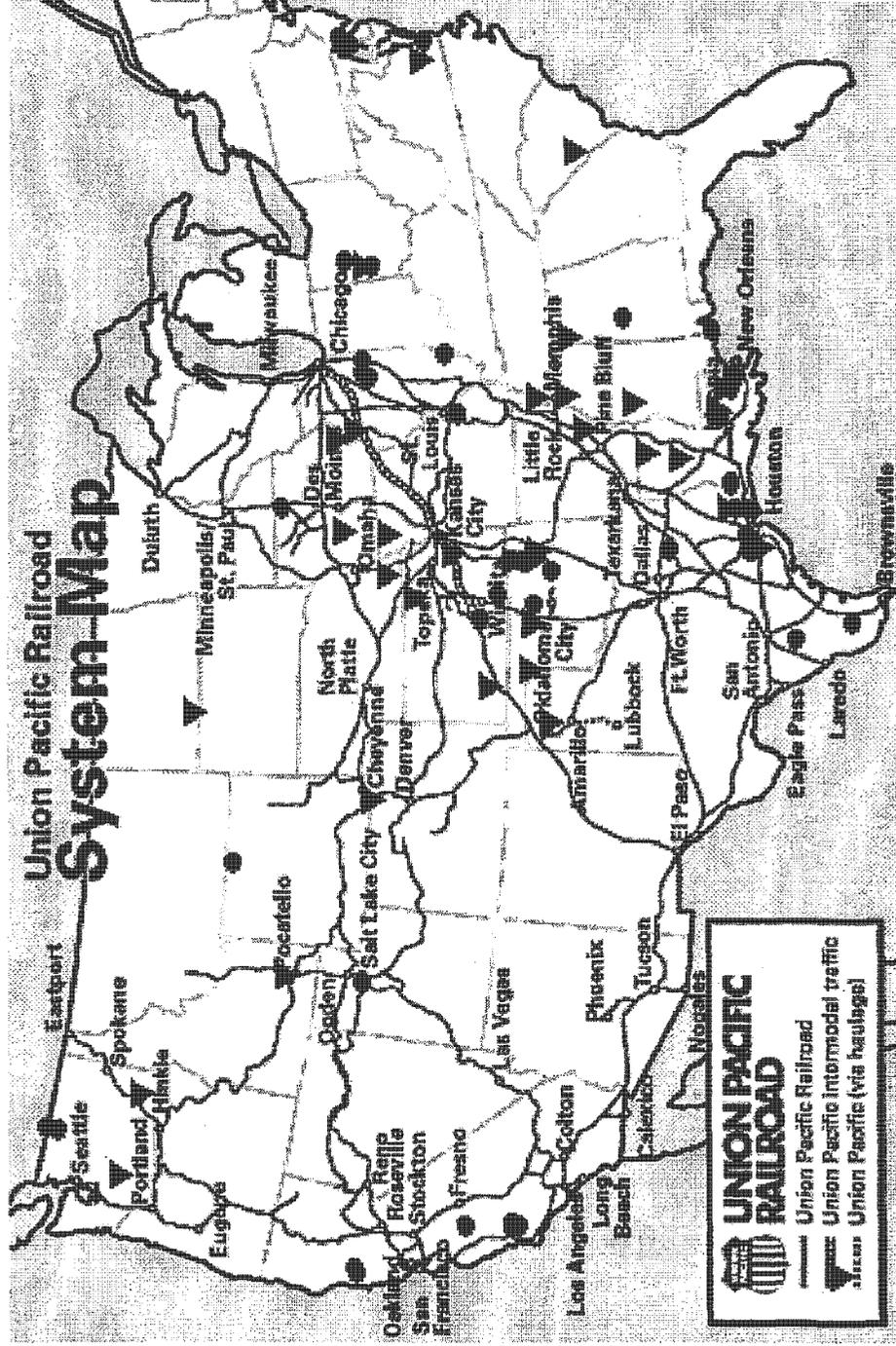
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Union Pacific



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Transportation Issues

- Cost
- Covered Cars for AS
- Loading & unloading facilities
- Back haul arrangements

Topics

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Permit

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A DAMES & MOORE GROUP COMPANY

IP12_013693

Confidential

Ammonia

JSK, IPA Kick-off Meeting 8/10/99

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Fly Ash

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Emissions

- SO₂
 - ✓ Unchanged or reduced
- NO_x
 - ✓ Unchanged or reduced
- Fly Ash
 - ✓ Unchanged or reduced
- Ammonia
 - ✓ Less than 1 ppm
- Mercury
 - ✓ Reduced
- Chlorides
 - ✓ Reduced



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NSPS Concerns

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Environmental Issues

- Permitting
- Ammonia Storage
- Combustion byproducts
- Emissions
- Heavy metals & Mercury
- NSPS Concerns



Topics

- Introduction
- Conversion Concept
- Feasibility Team
- Feasibility Study Scope of Work
 - ✓ Technical Issues
 - ✓ Pet Coke
 - ✓ Ammonium Sulfate
 - ✓ Ammonia
 - ✓ Transportation
 - ✓ Environmental Issues
 - ✓ Legal Issues
- Cost Estimate
- Action Items

Legal Issues

- Private use determination
- Memorandum of Agreement
- Definite Agreement



Topics

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Cost Estimate Issues

- Detailed Cost Estimate

